

# Citizen Science Practical Scientific Experience



## Chapter Goals:

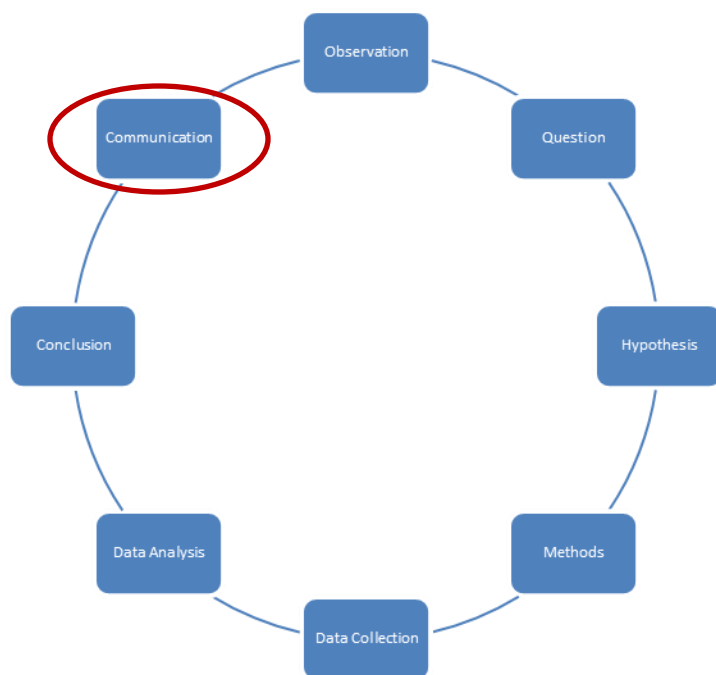
After completing this chapter, volunteers should be able to:

- Review a scientific article and identify the steps in the scientific process.
- Participate in data collection as a group and learn how it fits into the larger scientific process.
- Demonstrate the ability to successfully use GPS receivers and read topographical maps.
- Identify and demonstrate proper field safety techniques and Leave No Trace principles.

## Reading a Peer-Reviewed Scientific Article

One of the first steps, in the scientific process outlined in the Citizen Science Learning about the World with Science chapter, is “communication.” Sharing results of research with others, as well as giving others a chance to scrutinize the scientific process, is an important part of science. Some research projects are published in peer-reviewed scientific journals.

Peer-reviewed journal articles can be intimidating to read. One factor contributing to this is



8 steps of the Scientific Process

scientists, who write for scientific journals, write for other scientists, not the public. Scientific journal articles that are written well are understandable with a little effort. A variety of scientific journal articles will be provided for you to read. You are welcome to find your own, those that cater to your interests. Try to identify all the steps in the scientific process. You may not understand some of the content of the sections in these papers. Some of the data analysis description can be very technical with statistical details. Skim the parts you do not understand.

If you do not find all the parts of the process explained in the paper, do not worry. The author may have had limited space to write and left one step out on purpose. Generally speaking, it is unacceptable to leave out large portions of the process in a scientific paper. The point of papers like these is to share information, knowledge, and create an opportunity for other scientist to scrutinize your work and process.

## Nature Journal Entry:



### Group Data Collection Exercise

Date:

Time:

Location:

Weather:

Agency/Organization Volunteering for:

Researcher:

What was the research question? What was the hypothesis?

Why was this data being collected? For what will the data or conclusions be used?

How did you collect the data?

Was the protocol for collecting data clear and easy to perform?

Did you take samples?

# Nature Journal Entry:



## Reviewing a Scientific Journal Article\*

Journal:

Title of Article:

Year:

Authors/Researchers:

### Research Question:

Was the research question(s) explicitly stated? If so, what was it? If not, what do you think the question(s) was?

### Hypothesis:

Did the authors explicitly state the hypothesis? If so, what was the hypothesis? If not, what do you think their hypothesis was?

### Methods:

Without going into too much detail, were the methods adequately explained, in your opinion? Briefly, what were the methods of collecting data?

### Data collection:

Was data collection described and/or was data presented?

### Data analysis:

Was data analysis described? How did the authors analyze data?

### Conclusion:

Were the authors clear about the conclusion of their research? Did they reject or fail to reject their hypothesis?

### Communication:

Do you think the authors communicated their research process and findings clearly? How was the writing style? Did they communicate all the steps?

Did the authors reveal any limitations to their process? Did they disclose any threats to the validity of their research findings? Do you see any problems with their process?

**\*In the IMN core curriculum, there is a Nature Journaling chapter. When a participant gets to this part of the Citizen Science curriculum, they will have already read the chapter on how to keep a nature journal.**

## Field Safety Basics

While working in the field collecting data or helping with a citizen science project, there are several safety considerations to keep in mind. Most safety procedures are common sense and are things we do to keep safe, no matter how we spend time outside. The most important thing to remember when doing field work is if you ever feel uncomfortable with what you are doing, you feel it is unsafe or risky just do not do it. No data is more important than your health and safety. If you are not safe, there is no data. Take care of yourself first. Then, concentrate on your data collection task.

One of the most important aspects of field safety is being prepared. Having the supplies you need and the proper clothing for the task and weather are essential. Consider making a list of everything you need for a day's work in the field and checking it each time you leave. Below is a suggested list, although, it is best to make your own.

### Water

Keep well hydrated, no matter how thirsty you are. Thirst is actually a poor indicator for hydration. If you are thirsty, you are way behind in hydration. The outside temperature, how strenuous the field work is, and what you are eating are just a few factors that will determine how much water you should drink. Your urine should be "light colored" or "clear." That is right. To meet this goal, you need to pack a lot of water or bring a water purification system with you. Never drink directly from a lake, stream or spring. If you will not be far from a vehicle for long periods, store extra water there.

### Food

It is better to bring too much food than not enough. Bring things you like and foods you are used to eating. Store extra granola bars, or candy bars in your backpack or vehicle, for times when you need a little more nutrition.

### Raingear/Warm Gear

You know Idaho's weather changes suddenly. Wind could be the culprit, not rain. In either case, a good raincoat will provide you with protection. Raincoats should be carried at all times, no matter the weather. If nothing else, it is nice to sit on if the ground is wet. Bring an extra warm layer of clothing.

### Sun Protection

While volunteering for an agency or organization, sun protection is not a choice. You need to cover your skin with fabric or sunscreen. Sunburn will speed up your dehydration and makes you miserable. A wide brimmed hat and sunglasses will help too. Covering your skin for sun protection can also double as a barrier to mosquitoes and ticks!

### **Pen/Journal/Data Sheets**

Have pens, pencils, and back up writing utensils. Have plenty of data sheets. Take more than you think you will need. Make sure to have a clipboard or hard surface to write on and a plastic bag to store data sheets, in case it rains.

### **Tools for Work**

Take measuring tapes, tape recorders, thermometers, binoculars, flagging. Whatever is needed for data collection must be packed. The knowledge of how to properly use each tool is essential for safety. Be sure the tools you have are right for the job and in good working condition. Do not hesitate to ask for materials you need to do the job right.

### **Trowel/Toilet Paper**

When nature calls, you will need to listen. See the *Leave No Trace* information below for specifics on proper disposal of waste where there are no developed outhouses or bathrooms available.

### **First Aid Kit**

More important than a first aid kit, is the knowledge to know how to use it. Familiarize yourself with first aid techniques, or take a class. If you need any special medication throughout the day, or if you are allergic to bee stings, make sure you have what you need. Some general pain relief medication, such as aspirin or Ibuprofen, might help minor discomforts.

### **Map/Compass**

Only bring these if you know how to use them. If your project requires you to do map work, make sure you have the correct maps.

### **Cell Phone (If there is service.)**

Just in case you need to ask questions or call for assistance bring your cell phone. Be sure to carry the phone numbers of the office or the researcher. Program them into your phone, or keep them handy. Cell phones have a built in GPS that could aid Search and Rescue if you were to become lost or injured.

### **Trash Bag**

A plastic bag can serve many purposes in the field. You can pack out your trash from lunch and project flagging in addition to trash you might find. Though trash collection is probably not what you will be out in the field doing as your volunteer service, picking it up is good stewardship. Do not go out of your way while collecting data in the field. However, if you see trash in the parking area or your work area, toss it in your plastic bag and pack it out when you leave.

## **Insect Repellent**

Idaho's mosquitoes may carry West Nile virus. Twenty percent of people infected will develop symptoms. The virus can be fatal. To prevent infection, wear protective clothing and use insect repellent. Dead crows, ravens, and magpies in an area may indicate the virus is present in the area. "Fight the Bite!"



IDAHO DEPARTMENT OF  
**HEALTH & WELFARE**

[www.westnile.idaho.gov](http://www.westnile.idaho.gov)

## **Flashlight**

Unless you are helping with owl or bat surveys, you probably will not be volunteering at night. However, it is a good idea to keep a flashlight or headlamp in your backpack for unexpected emergencies.

## **Knife**

A pocket knife comes in handy to cut your bagel for lunch or free some flagging from a tree. Knives always seem to get used in field work.

## **Whistle**

Some recommend a whistle for emergencies. It is a way to signal to others if you need help. Commercial emergency whistles are light and designed to have a sound that carries up to a half mile.

## **CD**

A used/old CD is lightweight and can be used for digging, holding items together or as a light signal in an emergency.

## **Gloves**

Gloves can protect your hands from cuts, scratches, insect bites, and poisonous plants. They are helpful when you need to pick up something in the underbrush or disposal of waste.

## **Space Blanket**

A space blanket can be purchased at most outdoor shops for under \$5. This is a safety item in case you get caught in bad weather or are out for longer than anticipated.

## **Camera**

A camera can come in handy during data collection, even if photos are not required in the protocol. If you have trouble identifying something, or you see something you have a question about, or seems interesting, you might want to take a photo of it. It is important, when taking a photo of something you are supposed to be recording, to write down where you took the photo,

what time it is, the sample plot you are in, your aspect and photo direction. You must use your compass. Having an inanimate object, such as a pen or shoe in the photo, helps with perspective.

Whew! That is a lot to carry! There are also many things you can carry in your head that will help you be safer in the field.

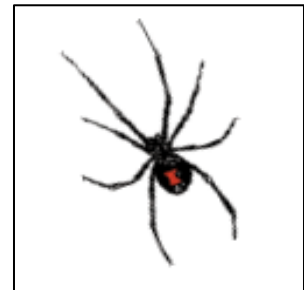
## Hazards Associated with Animals and Insects

### Spiders

We have discussed West Nile Virus and preventing infection while working in the field. There are two poisonous spiders in Idaho worth being able to identify! **Hobo spiders** prefer undersides of rocks and debris. They are not good climbers. Note the “boxing gloves” on the male’s reproductive structures. The abdomen has chevron (V- shaped) patterns (possibly many of them) down the middle, with the chevrons pointing towards the head. **Black Widow spiders** like woodpiles and holes. They have a “red hourglass” on their back. Their nest looks like a large, white cotton ball.



Hobo Spiders (above) and Black Widow spiders (below) are Idaho's poisonous arachnids.



### Snakes

There is only one snake in Idaho that is a concern. The **Western Diamondback Rattlesnake** has a triangular head shape and rattles on its tail. **Gopher** snakes look similar, but they have a much narrower head and, of course, no rattle! Rattlesnakes are not found in high elevations, or in the northern Idaho Panhandle Region.



Western Rattlesnake, © Loren Thomas.



Gopher Snake. Notice the slim head. (stockphotos.com)



## Black Bears and Grizzly Bears

The best way to deal with bears is to avoid them. This requires knowing some situations that might indicate bear activity. Large, turned over rocks and logs, berry patches, and fresh scat may indicate there may be bears nearby.

Most black bears will run away from humans! Sometimes, when they are caught off guard, have a cub, or are defending a food source, black bears can be aggressive and initiate a predatory attack.

Comprehensive information on black bears and grizzly bears is located on the *Center for Wildlife Information* website:

<http://www.centerforwildlifeinformation.org/index.html>.

Read the opening letter on this page, and then click on the “*Be Bear Aware*” button on the left. From there, click on “*Bear Encounters*,” “*Bear Spray*” and “*Black/Grizzly ID*” and read the information.



Black bears live in almost all forested areas in Idaho. Notice the flat, slanted profile.



Grizzly bears live in the shaded areas numbered 1-6. Notice the distinct shoulder hump and relatively small ears. The snout of a Grizzly bear is more dish-shaped than a black bear. Photos © IDFG.

### Grizzly Bear Recovery Ecosystems

- 1 North Cascades
- 2 Selkirk
- 3 Cabinet-Yaak
- 4 Northern Continental Divide
- 5 Bitterroot
- 6 Yellowstone  
\* De-Listed Population



Grizzly bear range in the western United States. Map created by Brent Thomas, IDFG.



# Nature Journal Entry:



While reviewing the Center for Wildlife Information website (<http://www.centerforwildlifeinformation.org/index.html>) answer the following questions.

FEATURE	WHICH BEAR?	
Dish snout profile	Black Bear	Grizzly Bear
Brown	Black Bear	Grizzly Bear
Track with smallest pad below other pads, horizontally	Black Bear	Grizzly Bear
Does not have a distinct shoulder hump	Black Bear	Grizzly Bear
Ears smaller and more rounded	Black Bear	Grizzly Bear
Can climb trees with 1 ¼ inch claws	Black Bear	Grizzly Bear

What are the two types of confrontations with bears?

According to this website, conflicts with wildlife are primarily due to what?

If you see a bear, what are some behaviors it might display to show you it is upset?

If you must administer bears spray, about how far away should the bear be from you?

## Poisonous Plants

As a general rule, when out collecting data or doing field work as an Idaho Master Naturalist, do not eat any plants. Even if you can properly identify plants and you know they are safe, it is best not to take this risk while working. The Panhandle National Forest, in northern Idaho, lists 28 species of poisonous plants!



Poison Ivy, Jennifer Anderson @ USDA - NRCS

## Driving

When volunteering on a citizen science project, you are representing the agency for which you are volunteering. Drive according to the laws. Be courteous, no matter if you are driving your own car or an agency vehicle. If in an agency vehicle, know the agency's protocol for recording mileage and buying gas before you begin your work.

## Notification

Letting someone know where you are going and when you will be back is important. This can be someone from home or someone from the agency or organization for which you are working. Many agencies have their own field safety requirements. We will not list all of them here. Know the field safety protocol of the agency for which you are volunteering and ask about hazards associated with the work.

## Leave No Trace

*Leave No Trace* (LNT) is a non-profit educational organization that promotes low impact outdoor recreation. Most state, federal, educational, and private organizations that provide recreational opportunities, or employ field personnel, follow *Leave No Trace* principles as part of their policy and/or regulations.

No matter how you recreate in nature on your own time, you will be expected to follow LNT principles to the highest degree while volunteering for an agency or organization as an Idaho Master Naturalist. It is your responsibility to know these principles and the skills needed to follow them while you are in the field.

A detailed description of LNT skills is available on the website. Use this information to familiarize yourself or update your LNT knowledge. LNT principles change over time, based on new science or social conditions. It was once acceptable to bury your garbage while working or recreating in the field. Now, this practice is completely unacceptable and rarely practiced. It used to be taught that toilet paper should be burned or put in the "cat hole" after use. Now, this not recommended at all. Packing out your toilet paper is suggested and is practiced by most experienced field staff and recreationists.



Visit [LNT.ORG](https://www.lnt.org)

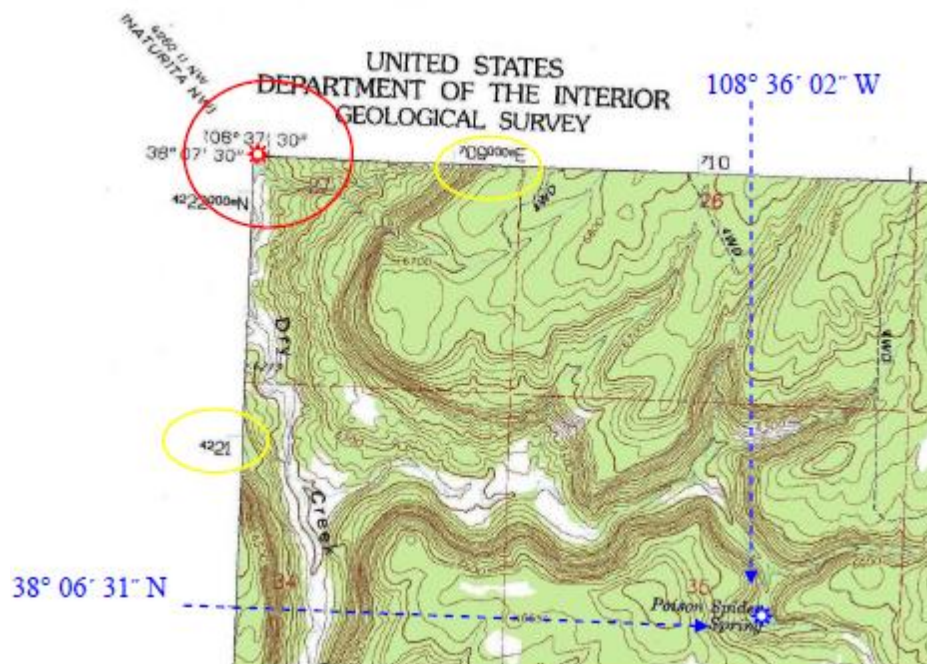
### 7 Principles of Leave no Trace

1. Plan ahead and prepare.
2. Travel and camp on durable surfaces.
3. Dispose of waste properly.
4. Leave what you find.
5. Minimize campfire impacts.
6. Respect wildlife.
7. Be considerate of other visitors.

Remember, how you are used to minimizing your impacts in the field may be outdated! That is no problem! You can adopt new practices and join the growing group of people setting the example for others. Keep an open mind. Remember, it is part of your responsibility, as an agency representative, to practice LNT.

## Using Maps, Compasses and GPS Units

Being proficient using maps, compasses and GPS units takes considerable training. Depending on what project you volunteer for, you may or may not need these skills. Below is a brief overview of map features and skills, and GPS skills. Consider this just an introduction. If you are interested in learning more about maps, compasses and GPS units, consider taking a class on these skills as part of your continuing education requirements.



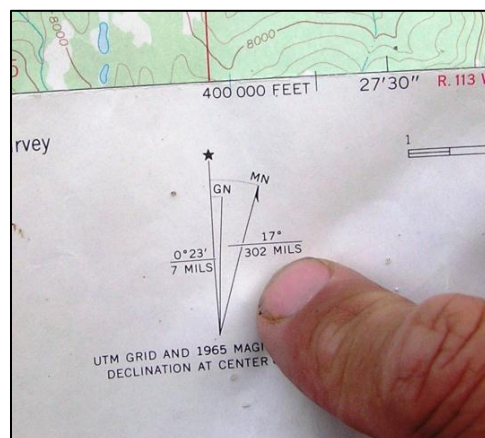
### Topographical Maps

- *Name of map* - The name of the map is located in the top right corner of the map margin. The name is usually associated with a prominent feature on the map.
- *Scale* - the map scale should be shown in the margin of the map. This will give you an idea how far apart features are and how much area your map covers.

- *Latitude/Longitude* - You will notice around the margins of your map there are two sets of numbers. In the corners, there are numbers that represent the latitude and longitude lines. More latitude numbers are evenly spaced along the sides of the map. More longitude numbers are evenly spaced along the top and bottom of the map. You can place a numeric value for the location of anything on the map using a latitude value and a longitude value. For example, if you were located on the \* dot in the upper left hand corner (see the above map), your latitude, longitude reading would be  $38^{\circ} 07' 30''$  N (latitude) and  $108^{\circ} 37' 30''$  W (longitude). If you were located at Poison Spider Springs, you would be at  $38^{\circ} 06' 31''$  N and  $108^{\circ} 36' 02''$  W.
- *Universal Transverse Mercator (UTM)* - It is the other set of numbers along the edges of your map (see circles on the left margin and along the top margin of the above map). This system also uses a set of coordinates to locate points on the earth. The easting and northing are the two coordinate numbers reported for each location. Above, Poison Spider Spring is located at 12 710360 E and 4220584 N.

When collecting data for an agency or organization, as a citizen science volunteer, be sure you understand how the agency wants point coordinates to be recorded; in latitude, longitude or UTM's. If you are using a GPS unit, collecting this information is as easy as the touch of a button. If you need to figure coordinates from a map, you may need additional training and practice.

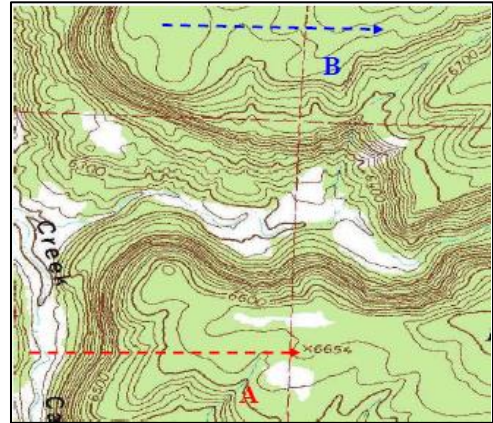
- *Declination Arrow* - A declination arrow is located in the middle of the bottom margin of a topo map. It will tell you the difference (in degrees) between true north (what your map was drawn from) and magnetic north (where your compass points). In Idaho, the compass will point a little to the east of true north. The declination is said to be easterly. Declination must be adjusted when using a map and compass. See the compass skills section below to learn how to adjust for declination.
- *Contour Lines* - One of the most striking features of topographical maps is all the brown wavy lines! These contour lines represent the topography, the relief, or the "lay of the land." Contour lines are lines drawn on a map that connect points of equal elevation. If you walk along a contour line, you neither gain nor lose elevation. Each line represents X number of vertical feet, depending on your map. When you see contour lines very close together, get ready for hard hiking. The



Magnetic north is labeled MN, where true north is designated with a star. Your compass will point to magnetic north. Your map is printed to true north.  
Photo, Sara Focht.



terrain is steep. When contour lines are very far apart, you will be walking on flat ground. Contour lines represent a line that has the same elevation. Each line on the map represents 200 vertical feet. Following the dotted line, A, from the creek bottom to the peak, you would be walking up a very steep hill, probably a cliff. Line B represents a nearly flat walking surface.

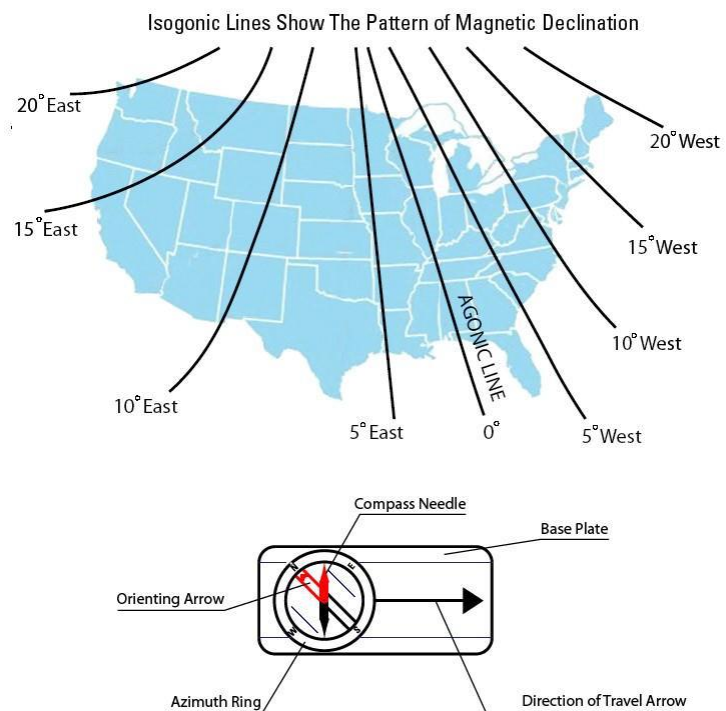


Map showing contour lines.

- *Colors* - Different colors represent different types of topography.
  - Green – vegetation
  - Blue – water
  - Purple - updated information
  - Pink - built-up (urban) areas
  - Brown - topographic contours
  - Red - land division system grids
  - Black - transportation and buildings

## The Concept of Declination

Declination is the difference between true north, and magnetic north (expressed in degrees). Your compass will always align itself with magnetic north. Your map is aligned to true north. Why would mapmakers do this? The magnetic poles on earth actually change in time. Mapmakers always print maps pointing to true north, so they do not constantly have to make new maps! If you to ignore declination while working with a map and compass, you will be incorrect in everything you do!



Magnetic declination varies through time and space. You can look up the current declination for any area in the United States on line. Map used with permission from USGS.

In Idaho, declination is said to be “easterly.” This means your

compass reads magnetic north, just slightly to the east of true north. In the eastern United States, the declination is said to be “westerly.” This means the compass would read magnetic north just to the west of true north. If your USGS map is more than 15 years old, it is advisable to get a reasonably current figure because declination varies over time. If you were standing in the Panhandle of Florida east of Panama City, your declination would be “zero.” Magnetic and true north are the same. You would not have to deal with all this declination business! See Figure 1 for a map of the United States and declination.

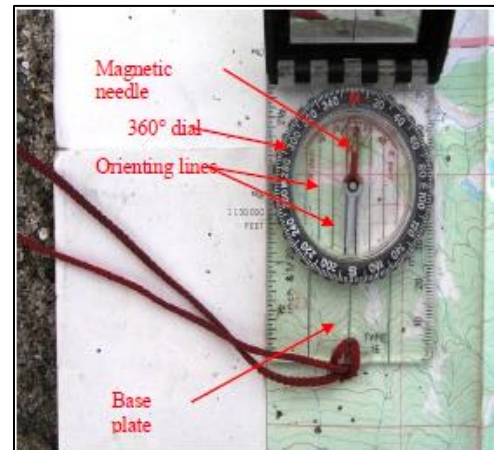
There are many ways to adjust for declination.

- Use tape to mark your declination on your compass.
- Buy a compass with a declination adjustor.
- Add and subtract the declination when you are using your map and compass skills.
- Draw declination lines across your map.

Compasses that have declination adjustors are expensive. Adding and subtracting declination is a little tricky. In addition, drawing declination lines on your compass can be difficult to get accurate. The following four map and compass skills are going to use the tape method. Before you begin practicing these skills, place a piece of tape on the back of your compass corresponding with the declination for the area. If the declination of the area is 15 1/2 degrees easterly, place the tape on 15 1/2 degrees on your compass. This could be the declination somewhere in Idaho.

If you have previous compass experience, you may have learned using one of the other methods listed. If so, you probably remember hearing about “boxing the arrow” or “put red Fred in the shed.” These two terms are used to help people remember to line up the magnetic needle with the red rectangle on the base plate. Using this tape method, to adjust for declination, you will have to be “boxing the arrow” or “putting red Fred in the shed.” You will always be using the tape to line up your magnetic needle. “Put red Fred on the tape” just does not seem to have the same ring to it. Maybe it is just silly enough to remember.

Before practicing compass skills, remember that compasses are always held flat, as if the compass were sitting on a table. If you are working with a compass, and are not holding it flat, there is a



Parts of a compass.  
Photo by Sara Focht, IDFG.



Notice the tape place at 15 1/2 degrees east.  
Photo by Sara Focht, IDFG.



risk the needle will give you a false reading. Hold the compass at your abdomen, flat out in front of you, as if it were a lunch tray. To avoid “tipping your lunch tray,” be sure to hold it flat.

## Valuable Skills for You to Acquire

### Skill #1 - Orienting Your Map to True North

Why should you do this? Orienting your map to true north is helpful if you want to have your map match the landscape. If you orient your map to true north, adjusting for declination, you do not have to adjust for declination later.

- Make sure the tape is on your compass along the degree of declination for your area!
- Turn the dial on the compass so North is aligned with the direction of travel arrow.
- Turn your body and compass until the red magnetic needle is aligned with your tape.
- Put your map on the ground. Carefully place your compass on top of it. Turn the map only until the orienting lines on the map are parallel to the north/south lines on the map.
- Your map and the landscape are perfectly aligned.



When wanting to find north, or orient your map to true north, put tape on the back of your compass along the degree of declination for your area. 2. Turn the dial on the compass to North. 3. Rotate with your compass until the magnetic needle is lined up with your tape edge.

Photo by Sara Focht, IDFG

### Skill #2 - How to Take a Map Bearing and Use it for a Field Bearing

Why should you do this? If you know where you are on a map and you have located another point on the map that you would like travel to, you can take a map bearing to help you travel to that location.

When taking a map bearing, for travel to a destination, you must adjust for declination somewhere in the process. There are several places in the process to do this. You may observe other people adjusting for declination differently.

- Make sure your tape is on your compass!
- Place your compass on the open map with one edge of the base plate lined up with your current location. Rotate the base plate so its



edge lines up with where you want to go.

- Turn the compass dial until the orienting lines are parallel to the map's north/south lines.
- Read your bearing.
- Stand up and hold the compass properly. Turn the compass and your body until the needle points to the tape.

### **Skill #3 - How to Plot a Field Bearing Onto a Map**

Why would you do this? You may see a feature on the landscape that you cannot identify on the map. If you know where you are, you can take a field bearing to help you identify the feature. If you do not know where you are on a map, but you can identify several features on the landscape and map, you can plot several field bearings to find your location (triangulation).

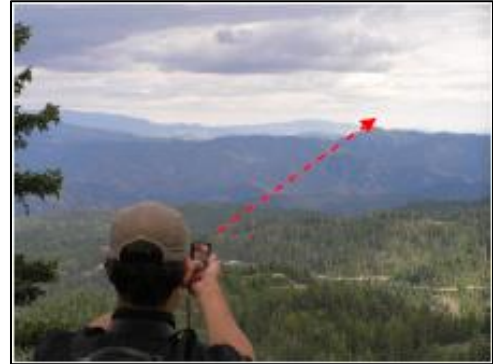
- Make sure your tape is on your compass!
- Hold your compass in the direction you want to travel, or toward the feature you are trying to identify. Line up the feature in the notch of your compass.
- Turn the compass dial until the needle points to the declination tape. Use your mirror to do this, if you have one, being careful to keep the compass flat. Read your bearing!
- Place your compass on your oriented or un-oriented map.

Turn your compass until the orienting lines on the compass line up with true north lines on your map. Do not worry about the needle. Align the rear corner of the compass base plate with your current location and draw a line. The line should go through the feature on the landscape on which you took the bearing.

### **Skill #4 - How to Walk a Field Bearing**

Why would you do this? If you see a feature on the landscape that you would like to travel to, a field bearing will help you travel straight there, even when you cannot see the destination.

- Follow steps 1-3 of plotting a field bearing.
- Keeping the needle on the tape, walk in the direction of the traveling arrow on the compass.



Josh lines up the peak in the distance with the notch on his compass. Notice he is holding the compass flat. Photo by Sara Focht, IDFG.



# Global Positioning System

The **Global Positioning System** consists of 24 GPS satellites, portable GPS receivers, and various ground-based support facilities.

**GPS receivers** are the units you hold in your hands when you are hiking, collecting data, or geocaching.

A GPS receiver can:

- *Tell you where you are. (Marking a Waypoint)* - Your GPS can tell you exactly where you are, within a few feet, anywhere on the planet. This is the first thing that your GPS will do. Put the batteries in, turn it on, and stand outside. The GPS will do the rest for you.
- *Tell you which way to go next. (Finding a Waypoint)* - You can load destination coordinates into your GPS. The GPS will tell you which way to go to get there. Loading this information and using it to travel is the most important part of using a GPS.
- *Tell you where you have been. (Tracking)* - This is called "Tracking," and involves recording "Waypoints." (The GPS Primer, 2007).

## All About Waypoints

A waypoint is a record of coordinates, that is, longitude, latitude and altitude. There are two ways to find Waypoints. You can get them from someone else, enter them in your GPS, and have it guide you there (Finding a Waypoint) or you can use your GPS to record your present location for later use (Marking a Waypoint)."

Waypoints must be named. If you do not name them, the GPS will automatically name them and begin with 001, 002, 003, etc.

To take a waypoint, press and hold the ENTER/MARK key until the waypoint is displayed. Highlight SAVE and ENTER to save the waypoint.

To find a waypoint, press GOTO and select a WAYPOINT that has been entered into your GPS by you or someone else. Use the Compass, Map, or Highway page to navigate toward the waypoint.

## Tracking

Automatically recording waypoints at set intervals as you travel is called "tracking." These can be transferred to a map (manually or by computer download) to show where you have traveled. This is like a breadcrumb trail of where you have been.

- Turn on Track Log feature by choosing it on the Main Menu or Setuppage.

- Choose how you want the Track Log to record. There may be three choices: off, wrap, or fill.
- Choose how frequently you want a waypoint to be taken: time, distance, or automatic.

This chapter was written to guide you through some practical experience you may need before volunteering as a Citizen Scientist. Hopefully, reading articles in scientific journals has helped you solidify your understanding of the scientific process that you read about in the Citizen Science: Learning about the World with Science chapter. Safety and LNT features were highlighted to remind you of the important things to remember while volunteering for agencies and doing conservation work in the field. Map and compass skills, as well as GPS skills, need to be practiced. Do not just read about them. We hope you have the opportunity to practice these skills in training, or have been informed where you can get more practice.

## Resources and Credits

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